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October 3, 1995

Ms. Ann Merwarth
Manager, HST Operations & Ground Systems Project
Goddard Space Flight Center - Code 441
Greenbelt, MD 20771

RE: HST VISION 2000 Program Peer Review Panel Report

Dear Ann,

Attached is the report from the HST VISION 2000 Program Peer Review Panel. The Panel hopes that the inputs to you and the HST Team are helpful.

We are looking forward to the next review to support you as you implement the necessary systems to achieve the vision presented during this review. I have distributed the report to those listed below and have left the internal Project distribution for your office.

Sincerely,

Gael F. Squibb
Manager, Mission Operations Development Program Office

Distribution
Preston Burch

Review Board

Roger Brissenden
David Kaslow (Not present)
Marvin LeBlanc
George Morrow
Ethan Schreier
Steve Tompkins

HST VISION 2000 PROGRAM

REVIEW PANEL
REPORT

CONCEPT CONFIRMATION REVIEW

October 3, 1995

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Gael F. Squibb
Chairman
October 4, 1995

Review Panel Members Present at the Concept Confirmation Review

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Roger Brissenden - SAO

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Marvin LeBlanc - JSC

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George Morrow - GSFC

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Ethan Schreier

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Steve Tompkins

The review was held at GSFC on October 3, 1995. The purpose of the review was for the Review Panel to validate the Vision 2000 Rationale, Concept and Approach and to make comments to the HST O&GS Project that will aid the project in achieving the Vision presented. The Panel wishes to thank the presenters for the clarity and openness of the presentations that have enabled us to make comments which we hope will be helpful.

The project is to be commended for establishing a vision, and having all members of the project understand that vision, and use the vision as a guide for their day to day activities. The vision was a primary theme of all the presenters, and this will be a key aspect in enabling the project to reach the Vision 2000 goals.

The Review Panel also commends the Project for openly addressing and solving long standing problem areas that are a result of heritage, legacy, and technology that has been superseded since the initial design of the flight and ground system. All of the "operational tall poles" that were known to various members of the Review Panel have been addressed, and a concept for resolving them in an efficient manner presented.

The Project and the presenters made continual reference to the badge-less Project Development Teams. The Panel concurs with this approach and also notes that there was no mention, even in an inadvertent way, of the STScI vs GSFC relationships that have existed in the past. It is apparent from the 8 hours of discussion that the Vision 2000 project has indeed achieved a unified team approach.

One of the Review Panel members referred to the plan as "a fantastic initiative" and it is in this vein that the remainder of this report addresses the various areas. The report is intended to provide constructive suggestions and items to consider or to watch for during the coming months. Consequently, action items are not assigned, nor suggested. Further, the comments are in much more detail than in a formal board report, to aid in transferring the suggestions and cautions from the panel members to the project.

GENERAL

Many of the concepts, and precepts discussed, require HST Project and NASA Management support. The GSFC and Headquarters management must be part of the Vision and support the changes, some of which could be perceived to increase risk. The changes to s/w methodology, the scheduling of fewer TDRSS passes, increasing the time between up-links, all must be enthusiastically supported as a low risk way of achieving resource reductions. Then when and if problems occur, the entire NASA team solves the problem, rather than finding fault and convening review boards. Changing philosophy is broader than Vision 2000 and needs to be addressed by the HST Project and NASA. **We recommend seeking and establishing commitment from GSFC and Headquarters management as part of the Vision 2000 Project confirmation.**

JSC commented that many of the rationale for the vision were similar or identical to what JSC has just gone through. As problems are encountered, JSC offered to review and offer advice based on their control center upgrade experience. The problems that JSC encountered in reaching their control center vision were 10% organizational, 10% technical and 80% political / budgetary. If GSFC has a similar experience, then a strong commitment by management at all levels will be required for the success of Vision 2000.

The project is encouraged to develop a process for accomplishing cost vs value analysis. The PDT leaders must keep low value additions from creeping into system again. The Panel Chairman shared some metrics that are being analyzed at JPL for showing if specific automation concepts are effective in lowering operational costs. The HST Operations & Ground Systems Project will be put on distribution for this work and were asked to suggest improvements and comments. It has been useful on past re-engineering efforts to show where resources are currently spent vs where they will be after the re-engineering.

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At the Design Confirmation Review in April 1996, the panel suggests that at least the following topics be addressed:

1. Design Architecture for each PDT
2. Demonstration of objectives met by PDT
3. Cost / benefit analysis for each PDT and at the system level
4. Demonstration that the 4 PDT designs will integrate into an efficient overall system.

The Steering Group of 16, is too large and not focused enough to perform an oversight function. **The Panel recommends that a small team of people be established to guide the Vision 2000 Project. In addition this team should also confirm that the design and implementation will not impact HST safety and reliability.**

Achieving Vision 2000 will be a challenge, but the continuing challenge will be to keep current with technology over time, after the year 2000. JSC suggested that a concept to accomplish this is to ride the technology wave of the commercial sector, and ensure that your architecture and design will allow this to take place. Implicit in this statement is the use of COTS wherever possible and the use of standard interfaces as opposed to custom software and interfaces. The **HST O&GS Project should develop a long range plan that allows for evolution of the capabilities reached in 2000, such that improvements are made gradually with technology changes, rather than being outdated with new technology and then requiring another step functions change.** This will probably require that a small amount of resources be established to track technology changes and keep the system up to date. JSC and other members of the panel have found that small, fast, successful upgrades keep the support of management, the funding coming, and the support of the operations staff running the current system.

Even though the HST will have considerably more spacecraft capability, it will not automatically result in more margin, unless an aggressive resource management plan is established during the development of the vision. **Specifically, resources such as flight computer memory, CPU cycles, etc. should be managed and cautiously allocated during the implementation of the vision.**

Public and Education Outreach is important, but not key to reaching the staff reduction goals that have been set. Although part of the Vision, there was no presentation regarding this part of the project plan. **The Review Panel suggests that Public Education Outreach be handled outside the Vision 2000 program.**

VISION 2000 CONCEPT

The Panel confirms that the Vision 2000 Rationale and Concept are, in our opinion, right on the mark and will lead to a low cost, efficient operation of the observatory from the year 2000 onward. Many of the efficiencies will be seen in increasing magnitude during the period of 1996 through 1999, assuming that the implementation of the vision remains on the schedules presented.

ARCHITECTURE & ORGANIZATION

Security should be a major element of the Vision 2000. Moving from closed architectures to open will require articulate explanations to management and security officers regarding how the integrity of the system will be maintained. It is best to include this in the architecture, rather than complete your design and be asked the question, or worse yet asked the question after the implementation.

The use of the WEB for the dissemination of information both during development and operations will show a big payback and aid in organizing documents, sharing and accessing information.

PLANNING & SCHEDULING SYSTEM

The Panel was pleased with the aggressive approach to reducing the testing period to 3 weeks by using combined teams rather than serial and independent teams. This is another area where GSFC and NASA management need to be partners with the Vision concept.

The combining of scheduling systems to reduce duplication of functions, and the relocation of all elements of the planning and scheduling system is excellent and will certainly have resource payoffs.

The large amount of unique planning and scheduling software is understandable, but should be of concern. Active pursuit of COTS software for as much of this as possible will lower maintenance costs, if it can be found. Some of the panel members commented on how this area is usually described as mission unique, but that COTS tools are becoming available. One should also look at perhaps having a single planning and scheduling system that is used by HST, AXAF and SIRTF (when it becomes a project) since planning and scheduling the observatory class missions have many similar aspects.

CONTROL CENTER SYSTEM

There were more comments by the Review Panel on this PDT, than on any other. This reflects the relative lack of maturity of the CCS effort.

A better description of how the new CCS can be mapped from the current system is needed. The panel had difficulty, based on the current maturity of this PDT effort to understand the design, and how the reductions that are projected will be achieved. Process definition is essential to change the system and the way that the satellite is operated. It is difficult, if not impossible for the board at this time to understand the magnitude of the changes, the resources to achieve this change, and to comment meaningfully on the ability to operate the satellite with the reduced staff. This area is more difficult to understand since it is a new system rather than one put together from existing code. **We suggest a separate short review of this PDT prior to the spring 1996 design confirmation review of the Vision 2000 Project.**

There are lots of decisions to be made in selecting the CCS components from COTS heritage. The Panel would like to understand how selections will be made in a timely fashion, consistent with the schedule and automation gains. These processes and management approaches need to be addressed by the CCS PDT at their next review. The presenters commented on the need to make requirements trades when using and selecting COTS products. The Panel strongly agrees and these trades should be documented and be addressed at future reviews.
Although the processes need to be changed and then a system designed, much of the presentation appeared to be more in the traditional role of: analyze, requirements, develop off line, and then see if it works. All of the Panel members expressed concern over the length of time before a prototype is available for user evaluation. Prototypes **of currently available expert systems need to be put on line and analyzed in parallel with the process definition, as this is a key concept in the CCS approach, no matter what the process definition**. Several commercial products exist so this should not be a government developed capability. The sooner this aspect of the CCS concept is proven, the better. This one process could then be run in parallel perhaps as a stand alone capability in a shadow mode, before the complete system by starting off with one sub-system, then adding another etc.

The automation of the down-link even though a large task, should be easier than the automation of the uplink. There is much less heritage, per one of the panel members, for the automatic uplink processing. This should be addressed in the next CCS review.

Co-location results in an N-squared gain, not linear. Keeping teams together is important. To many of the panel, co-location provides the highest payoff when developers are co-located with operators. The co-location of the development staff for CCS will help the development but cause development

to operational interface problems. It will also be more difficult for the operators of today's systems to be enthusiastic and to own the new systems

SCIENCE DATA PROCESSING

The Panel confirms and approves of the approach being taken in this area.

The Panel endorses the use of a distributed architecture as it results in more modular and scalable system.

This effort is the most mature and is nearing completion. The success demonstrated so far, e.g. code size reduction, provides confidence in the other PDT efforts. However the science data processing PDT should revisit the architecture and processes once the other PDT designs mature, and responded with new changes as necessary.

SSM FLIGHT SOFTWARE DEVELOPMENT

Use of a modern processor and developing in C will be a big step forward in achieving staff reductions, while having more capability for change and performance.

While development of flight code must be done in a low risk manner, this PDT did not discuss any examination of new or different ways of development that would reduce the resources required to develop and test the code. **It would be a useful exercise for the PDT to form a small team to see how others are approaching flight code development and see if any new approaches exist and are being used by other flight projects.**

Since the cornerstone of Vision 2000 is "change", the SSM flight software development approach must be able to accept new requirements after their PDR, to allow flight ground trades during the Vision 2000 implementation. Changes **should be expected, and a process developed to accept changes which lead to life cycle cost reductions**. The current plan as presented places a reasonably tight lid on changes after PDR.

SUMMARY & SCHEDULE

The final top level schedule looks complex. The Panel suggested defining a series of integrated PDT milestones, to demonstrate overall system buildup of functionality.